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HOW TO CHANGE HOUSEHOLD BEHAVIOUR WITH GREEN IT: REVIEW OF LITERATURE

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Abstract

This working paper gives an account of a literature review of what we know about changing household behavior with Green IT. It is a review paper meaning that we have been searching and reading the existing literature on behavioral change in relation to IT. And we have been searching the literature on Green IT.

Contents

1. Introduction to Intelligrid

The idea behind the Intelligrid project is to use available regenerative energy in a more efficient way. The demand of electrical power is not constant over the course of a day. The same applies to the production of electric energy and its availability in the power grid which fluctuates during the day for different reasons. It could be a very sunny day or the wind blows strongly, generating more power than can currently be used. Rather than switching the wind turbines off and "losing" the power, would it not be more efficient to switch on additional consumers? This is the idea behind the Intelligrid project. Using the electrical power in the grid when it is available.

2. Introduction to the problem we are looking at

The average temperature on Earth is on the rise. One important factor is the greenhouse effect caused by increasing levels of CO2 in the atmosphere. The Paris Agreement from 2015 aimed to keep the global temperature rise in the 21st century below 2 degrees Celsius and even pursue efforts to limit the temperature increase to 1.5 degrees Celsius (UNFCCC, 2015). In October 2018, however, The International Panel on Climate Change warned that "Limiting global warming to 1.5°C would require rapid, far reaching and unprecedented changes in all aspects of society" (Allen et al., 2018).

One of the solutions to reduce the rising temperatures is to lower or even abandon the use of fossil fuels such as coal and oil and use solar energy, wind power and other sustainable sources. But solar energy is produced when the sun shines, wind power is produced when the wind blows. Hence, consumption of energy for transport, heating, cooking etc. is often misaligned with the production of sustainable energy during a day or during a year. It requires technical solutions such as effective storage of energy – batteries – to save sustainable energy from day to night and from summer to winter. Despite the severe limitation of current lithium ion battery technology (Kraytsberg & Ein-Eli, 2011), recent research shows promise (Lin, Wang, Xiong, Shen, & He, 2019). While we wait for technology an alternative solution is to use the energy when it is produced through a behavioral change in private households and industry. However, changing behavior and maintaining the changed behavior is challenging. What motivates such a change? How do we ensure that the change is a lasting one? How do we coordinate with the electric grid so it keeps its balance and avoids unwanted peaks and gaps?

These questions about changing behavior of private households to consume energy when the wind blows and the sun shines led to the formulation of a research question for this working paper:

What do we know about creating a change of behavior in private households so that they use electricity when it is produced from sustainable sources?

3. Literature search method

To answer the research question formulated above we undertook a structured review of the literature on behavioral change to investigate and critically assess how behavioral change has been researched and conceptualized to date.

Literature reviews are an appropriate method to systematically and critically assess the state of research on a particular phenomenon: they help to inform concept and theory development (Rousseau, Manning, & Denyer, 2008; Rowe, 2014) and to develop agendas for future research (Boell & Cecez-Kecmanovic, 2014; Webster & Watson, 2002).

Our decision to include psychology publications was due to the limited availability of academic publications to date, to capture views and terminology of cognitive praxis and to access and include detailed reports of cases not found in academic publications with detail

Our interest was in the actual doing of behavioral change at an individual/household level (rather than success or performance measures).

To identify relevant academic sources, we conducted keyword-based searches in several leading academic databases to identify relevant sources, we searched leading online repositories (e.g., Gartner). We used keyword-based searches to avoid an overly narrow focus on particular outlets and to find all (or almost all) available publications (Kitchenham & Charters, 2007).

In addition, we used backward and forward searches (Webster & Watson, 2002). That is, we analyzed the reference lists of identified relevant publications (backward search) and, using the ‘‘cited by” functions of Google Scholar and Web of Science, we searched for newer publications citing.

Behavior change is the art of changing people’ behavior by using insights from behavioral science to sway how people make decision (Münster, 2019).

We were able to structure insights from the reviewed literature into a total of eight debates or issues that form central challenges or ways of coping for households when they try organize themselves to make green energy work for them.

3.1 Keywords and search strategies

Three main databases were used during the literature search: ‘ABI/inform’, ‘ebscohost’ and ‘soeg.kb.dk’

The literature search was performed using the key expressions “households”, “green technology” and “impact on behaviour”. This yielded 27 relevant results out of a total of 243.

The main query used was ["household behavi*" green technology energy].

Some papers were slightly problematic to access despite them being logged on to the main KB directory. Those papers titles’ are: “Ensuring effectiveness of information to

influence household behaviour" and "Nudging electricity consumption using TOU pricing and feedback: evidence from Irish households". They have therefore been omitted in this review.

Five further articles were found relevant for this review and added via a search using "household behaviour" as a key expression.

4. What we found in our literature review

Before any change happens, knowledge about the said change needs to be acquired by the person that are supposed to change behavior.

4.1 Knowledge and anchoring

Author Don Norman explores ways in which knowledge is gathered by individuals in his book 'The design of everyday things' (Norman, 2013). Don proposes two types of knowledge: Knowledge in the head and Knowledge in the world.

On one hand, knowledge in the head is to do with cultural constraints which are learnt restrictions on behavior that reduce the set of likely actions (Norman, 2013).This includes conceptual models, cultural semantic and logical constraints on behavior and analogies between the current situation and previous experiences with another situation (Norman, 2013).

Thus, the upbringing culture can have a huge influence in behavioral change. Don Norman coins the phrase 'Knowledge in the head' as a starting point for behavioral change. On the other, the idea of knowledge being available in the world, supports that much of the knowledge an individual needs to do a task can be derived from information in the world – through internet searches for instance.

Don Norman goes on to say perfect behavior results if the combined knowledge in the head and in the world is sufficient to distinguish an appropriate choice from all others. This then raises a challenge in terms of trying to marry what individuals know already (or their internal values) to the idea presented in the 'new' behavior.

Individuals often would use others 'experience from their internet search for example in order to form the basis of their own decisions – including behavioral change. Barry Schwartz (2004) coins the term 'Anchoring' in his book 'The paradox of choice'. Anchoring happens when an individual uses another's choice as a benchmark for the choices they make. A self-confessed nerd interviewee how he looked at the latest trends in smart home solutions to customize his own. He explained how knowledge is shared in various user groups he is part of.

4.2 Adoption of new things – Rogers' theory of diffusion of innovation

Moving on from that, knowledge trickles down from leaders - who could well be parents - to adopters. That is the subject in the book by Everett Rogers, 'Diffusion of innovations' (Rogers, 2010). This diffusion theory has proven one of the oldest yet most popular theories on how new ideas are spread and adopted across a wide range

of social systems with many different actors. The theory was pioneered in the sixties by Everett M. Rogers (Rogers, 2010) and has since been refined and re-confirmed in many Information Systems settings (Weigel, Hazen, Cegielski, & Hall, 2014).

It has been compared to other adoption theories such as the Theory of Reasoned Action (Moore & Benbasat, 1996), Theory of Planned Behavior (Ajzen, 2011), General adoption of technology systems in organizations (Green & Hevner, 2000; Mustonen-Ollila & Lyytinen, 2003), and database development environments (Nilakanta & Scamell, 1990) to mention but a few.

The main idea proposed by Rogers in this work is the speed and effectiveness in the spread of an innovation idea in a given social system based on different types of independent variables. The spread capacity is however tied to the type of innovation and the categories of actors involved in the social system.

4.3 Kahneman's theory of system 1 and system 2

Once gathered, knowledge is to be grasped and somehow put into play for the change in behavior to happen. This is where the work by one of the pioneers of behavioral economics (Kahneman, 2011) becomes very poignant. Nobel Prize winner Kahneman proposes that people draw on two main types of thinking called system 1 and system 2. System 1 is fast. It makes one act quickly and instinctively based on one's current needs and desires. It is helpful in situations where quick actions are needed and where the basic needs need to be met. For instance, it would be at play when one is hungry and thus has difficulties thinking.

System 2 is the more rational, cognitively taxing, and long-term way of thinking. System 2 is slow. System 2 considers, reflects and takes well-planned actions in the long term. Some examples will include setting up a child fund or deciding on when to inoculate children. System 2 thinking also has some setbacks. It takes up energy and is rather time consuming. Due to the energy demands of System 2, System 1 will often take over and make decisions requiring less cognitive effort. Appealing to and taking those two systems into considerations is essential when assessing behavioral change.

Authors and brothers Chip and Dan Heath (Heath & Heath, 2011) go further by using a rider and an elephant analogy when looking at behavioral change. In their New York Times No1 bestseller 'Switch', they propose three key factors in driving behavioral change:

First, 'Direct the rider'; the suggestion is that what looks like resistance to change is usually a lack of clarity. Second, they put forward the idea of 'Motivating the elephant'; it is to do with involving an individual and making them be part of the change in order to motivate them. Essentially, we have to stimulate individuals' interest in the change by making them part of it as oppose to the change being something "inflicted upon them".

Finally, 'Shape the path' – here the authors suggest that often when we think that people are stalling a change process, it is usually because of the situation they are in. Again, a combination of the above two ideas leads to this final one; the path or goal will be clear once the change is concrete and the individual is stimulated. Shaping the path with clear data or information will 'motivate' the elephant and in turn make it easier for it to be directed by the rider.

4.4 The hassle factor

When looking at household behavioural change, Carbone and Gazzale (Carbone & Gazzale, 2017) observe that when it came to motivating a large pool of individuals, “effort contributions to a public good -clean water projects for example- decreased when the share of peers who contributed with money to the public good increased”. This could an argument for explaining why Green energy production has not caught up with its adoption in households as yet despite the emergence of new players in the Green energy sector since the 2012 Paris summit.

In the Journal of Consumer Policy, De Vries et al. (2020) talk about “the hassle factor” in Green energy adoption”. They define hassle as the irritating, frustrating, distressing demands that to some degree characterise everyday transactions with the environment. Hassle includes annoyingly practical issues such as losing things or traffic jams, and chance occurrences such as inclement weather, as well as arguments, disappointments, and financial and family concerns (Kanner, Coyne, Schaefer, & Lazarus, 1981).

They warn that if homeowners experience accumulated hassle during their journey towards a Green home, their stress levels increase, which eventually leads to them avoiding implementing Green measures in their home (Kanner et al., 1981).

4.5 Changing energy consumption

Research by Vesterberg & Krishnamurthy (2016) in Sweden show that the cost implications of shifting load from “expensive” to “cheap” hours, using the Nordpool spot prices as a proxy for a dynamic price, are computed to be very small; a roughly 2–4% reduction in total daily cost from shifting load up to five hours ahead, indicating small incentives for households (and retailers) to adopt dynamic pricing of electricity. In other words, the monetary incentive is not enough to provide lasting household behavioural change towards Green energy consumption.

Matsumoto (2016) proposes a Green energy adoption model consisting of a household with two decision makers, one with the lowest income being the active “environmental saver” , undertaking all the Green energy consumption tasks. This suggestion is slightly utopian in relation to our two case countries Denmark and Germany, where it is highly acceptable to have households consisting of single individuals, and if a household consists of a couple, both individuals would typically strive towards a fair share of all the household duties, including energy consumption decisions in the household.

On the other hand, Prudence Dato (2018) provides evidence about factors that affect the probability of adopting renewable energy and of investing in energy efficiency – factors which can therefore lead to changes in energy consumption behaviour. The paper coins the term “energy poverty” to emphasise the fact that people living in poorer households are less likely to invest in energy efficiency measures (Dato, 2018). The author goes further by claiming that both the ownership and size of the dwelling are key factors in motivating members of households to be interested in energy-saving

discussions (Dato, 2018). They conclude that trust in researchers, scientists and experts has a pivotal and positive effect in changes in energy consumption behaviour of households.

Furthermore, an analysis by Abrahamse et al.(2005) presents a review of intervention studies that identifies key factors that change energy consumption behaviour. They propose measures to encourage households to move towards energy consumption reduction. Such measures include “commitment” by households in the form of an oral pledge, goal setting, information and modelling. They suggest commitment to be one of the most effective tools when it comes to nudging households towards a specific behaviour change. Katzev and Johnson (1983) propose similar ideas and present the “foot-in-the-door technique” to maximise the effect of commitment.

4.6 The theory of persuasion

Staying with the notion of commitment, Simanavicienne et al. (2017) present the theory of persuasion as a tool in communication before commitment can take place. They highlight three key principles of the said theory, which are reliability of the speaker, reliability of the argument and sensitivity of the recipient. They report this to form the basis for the shift towards behavioural change.

It is in the same chain of thought that a study based on household adoption of renewable energy in Mexico posits that the beliefs around the consequences of Green energy solutions are important factors in its adoption. Reyes-Mercado, P., & Rajagopal, R. (2017) suggest that beliefs are important, and can and should be influenced through learning, information and education.

Another related study by Bye & Nyborg (2003) suggests taxation as a political instrument for influencing household behavioural change. They present the case of Norway as an effective example for using differentiated taxes to motivate individuals to adopt greener energy consumption measures. This suggests a system where people will be presented with a higher tax bill unless they actively switch to an all Green energy consumption regime.

In relation to taxation instruments, Mahmoodi et al.(2018) present results from a representative sample of Swiss electricity consumers showing that consumers prefer tariffs that reward decreases in electricity consumption, rather than tariffs that penalise increases in consumption, thus showing that penalties do not always work, but that combining penalties and rewards achieve general acceptance.

Gneezy et al. (2011) similarly warn against negative “behavioural spillover” when it comes to influencing household behavioural change. This refers to the consequence that other behavioural areas can be affected negatively due to the adopting of a Green behaviour. For instance, this implies that we should consider what quality of life a household would have as a family if all their spare time was centred around Green energy monitoring. Also, we should consider what would the mental health or social cost be of adopting Green energy in certain areas if people went too much out of their way to make Green energy happen.

To attempt to answer such questions, Schusser and Bostedt (2019) plead for an Information System (IS) aiming at kick starting an overall Green behavioural change

that encompasses several lifestyle domains. This implies that IS design must meet the households' needs whilst also targeting the adoption of new habits, which in our case is the transition to Green energy consumption.

Allcott & Rogers (2014) present the long- and short-term effect of behavioural change and talk about capital stock measures (such as installing insulated roofs) leading to "backsliding", where the measures have an effect for some time and then leading to a "decay" that could cancel out the initial effect unless further measures are taken.

4.7 Nudging

Giving the user access to their data for instance – a way of 'shaping the path' -, could motivate such users to keep using a particular application. Sunstein (2019) refers to this as disclosure in his 10 principles for Nudging:

1. Use default rules, e.g. automatic enrollment in programs
2. Simplification
3. Use of social norms - emphasizing what most people do,
4. Increase ease and convenience
5. Disclosure - for example, the economic or environmental costs associated with energy use
6. Warnings, graphic or otherwise - as for cigarettes
7. Use precommitment strategies, by which people commit to a certain course of action
8. Use reminders - for example by email or text message,
9. Elicitit implementation intentions
10. Inform people of the nature and consequences of their own past choices

4.8 Six principles that can be used to make something stick

Morten Munster (2019) – that we mentioned above - is a bit more on the cautious side and does not think knowledge and motivation are enough when trying to instill a behavioral change. In his bestseller book "I am afraid Debbie from Marketing has left for the day" Morten Munster explores great literature on psychology to date – including Kahneman's work - to highlight five key misunderstandings in behavioral change. Morten uses vivid real-life examples to illustrate his points and relay that some of the behavior knowledge speak to system 2 (Kahneman, 2011) and are suited to a parallel universe, not the real world. He goes further in his literature review by mentioning the book by Mullainathan and Shafir (2013) Scarcity' and exploring the idea that the rational change that we target in our motivational talk is sometimes held back because of the 'bandwidth' in our minds already being taken by other things – basic needs for instance.

However, in this project's case there is a glimpse of hope at last, as far as behavior

change is concerned. This hope is offered by the brothers Heath (Heath & Heath, 2007) in their book 'Made to stick'. Essentially this hope comes as a recipe for success for making an idea – a behavior change- stick. The six principles proposed are: Simplicity, Unexpectedness, Concreteness, Credibility, Emotions, and Stories.

Given the current proliferation in smart-home solutions, the level of green energy consumption is yet to be sustainable. Resistance to change in real life is still somewhat a ubiquitous phenomenon. To use Mullainathan & Shafir's (2013) Scarcity theory, how do we therefore make Green energy scarce to attach great attention to its consumption?

5. Conclusion

We have now given an account of the literature on household behavior and Green IT. The main result is the identification of 10 issues or debate areas that we need to address in our further work.

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